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IX. *A Continuation of the History of Tipula Trilici, in a Letter to Thomas Marsham, Esq. Tr. L. S. by the Rev. William Kirby, F. L. S.*

*Read February 5, 1799.*

MY DEAR FRIEND,

*Barham, December 1798.*

AFTER all the pains we took last year to investigate the history of the Wheat Insect, we were obliged to leave it in some measure incomplete. This arose from our beginning our observations too late in the season, after the parent fly had disappeared. Determined to watch its progress this year from the first appearance of the ear, my success, in most respects, has been answerable to my expectations. I have not indeed yet been able to ascertain the male of our *Tipula*; but to make some amends for this disappointment, I have had an opportunity of observing all the motions of the female, and besides have discovered two new species of *Ichneumon*, which, in conjunction with that known before, and described in the last volume of the Linnean Society's Transactions<sup>(a)</sup>, under the name of *Ichneumon Tipulæ*, seem to be intrusted with the important office of restraining within due limits the numbers of that very destructive little animal.

Without further preface, I shall now proceed to connect and put into form the different memoranda which I have by me on this subject, having adhered faithfully to the Linnean maxim, *Nulla dies sine*

(a) Vol. iv. p. 232.

*linea*, and always taking my pencil and memorandum-book with me when I went into the fields to make my observations.

Previous to the season when the ear begins to emerge from the *folium vaginans* (b), I have, as opportunities of examining fir plantations occurred, been upon the watch for De Geer's *Tipula Pini* (c); but not being so successful as to meet with that insect, I cannot ascertain how nearly it may be related to its *congener* of the wheat. I was careful also, at the same time, to inspect the plants that were in blossom in the borders of the wheat fields, in hopes of finding (*copulâ connexos*) the two sexes of *Tipula Triticæ*, but with no better success.

It is to be observed that I had usually chosen the forenoon for making my inquiries. It chanced that on the third of June last I had occasion to pass through a field planted with wheat, in the evening, and, to my great surprise and satisfaction, my attention was immediately arrested by an innumerable host of our *Tipulæ* flying about in all directions; and from that day to the latter end of the same month these insects were always to be met with in the wheat fields. They were seldom to be seen much before seven o'clock; at eight the field appeared to swarm with them, at which hour they were all busily engaged in laying their eggs; and about nine they generally disappeared: they were indeed so extremely numerous, that if each of them were to lay its eggs in a different floret, and those eggs were permitted to produce larvæ, I think, upon a moderate calculation, more than half of the grain would be destroyed. I have no-

(b) I was strongly tempted to introduce two or three new words into this Paper, viz. *evaginate* and *evagination*, to express without a periphrasis the emerging of the ear from the *folium vaginans*, and *oviposition* for the laying of eggs, from the Latin phrase *ova ponere*; but lest this liberty should wear the appearance of affectation, I refrained from it.

(c) Linn. *Trans.* vol. iv. p. 228.

ticed twelve at one time depositing their eggs in the same ear. It is remarkable that amongst the myriads that I have seen of the female, I should not have observed one which I could take for the male: indeed, towards the latter end of the month, (24th,) I took two or three specimens, which, except that they had black bodies and were smaller, appeared exactly similar to our *Tipula*; but as neither their antennæ are hairy, nor their wings spotted, as was the case with the specimen you received from Mr. Markwick, they can scarcely be the male. Indeed the appearance of the male, instead of being later than that of the female, ought to be as early or earlier, in order that they may be in readiness to perform the work of impregnation previous to the season in which the females lay their eggs, which begins, at least it did this year, with the month of June. Hence I suppose that each sex is disclosed from the pupa in the genial month of May, when, to use the poetical language of Scopoli upon another occasion, "*nuptias instituunt, de loco in locum continuò volitantes, zephyro plaudente choreis (d).*"

Although these insects are so numerous in the evening, yet in the morning not a single one is to be seen upon the wing: they do not however then quit the field which is the scene of their employment; for, upon shaking the stalks of the wheat, or otherwise disturbing them, they will fly about near the ground in great numbers. I found their station of repose to be upon the lower part of the culm, with their heads upwards.

It is very entertaining to observe the method to which these insects have recourse in order to deposit their eggs in a situation where the larvæ may soon arrive at their food: when engaged in this employment they are not soon disturbed; which circumstance affords the observer an excellent opportunity of examination. As I hinted

(d) *Ent. Carniol.* n. 801, ubi de *Ape fabulosa*.

before,

before, a number may be seen at the same time upon one ear: they place themselves in such a position that their *anus* stands nearly at right angles with the margin of the glume of that floret which they mean to pierce. But how are they to introduce their eggs within the floret, for they deposit them between the exterior and interior valvules of the corolla? To look at them when they are not engaged in this employment, their *anus* appears to be furnished with no instrument adapted to so nice an operation; but upon pressure it exerts (*e*) a long retractile tube or *vagina* (*f*), which unsheaths an *aculeus* (*g*) (if I may so term it) as fine as a hair and very long. This *aculeus* it introduces into the floret, and there deposits its eggs, which it usually places upon the interior valvule of the corolla, just above the stigmata. After she has done laying her eggs, the insect withdraws her *aculeus* with great caution and deliberation: yet it sometimes happens that she is unable to effect this; in which case she is detained a prisoner until some enemy devour her. In this situation I have found them more than once in my morning walks. I was very desirous of seeing the eggs pass through the *vagina*, but my first attempts were unsuccessful: at length I was gratified with this pleasing spectacle. I gathered an ear upon which some of our *Tipulæ* were busy, and held it so as to let a sun beam fall upon one of them, examining its operations under the three glasses of a pocket microscope: I could then very distinctly perceive the eggs (*h*) passing one after another, like minute air bubbles, through the *vagina*, the *aculeus* being wholly inserted into the floret. I examined this process for full ten minutes, before the patient little animal disengaged itself; and at last it was through my violence that she discontinued her employment and flew away.

(*e*) For this sense of the word *exert*, see Johnson's Dict. Nos. iv. v.

(*f*) Tab. iv. fig. 2. a.

(*g*) Fig. 2. b.

(*h*) Fig. 2. c.

On the seventh of June, upon opening a floret, I discovered a small patch of eggs; they were oblong (*i*), transparent, and of a pale buff colour. I afterwards found several of these little patches, containing from a single egg only, to more than twenty. On the seventeenth I found, for the first time, a larva newly hatched: it adhered to the lower end of one of the anthers (*k*), and was perfectly transparent and colourless; from which circumstance I conjecture, that it had taken no food. I afterwards detected two more in a similar situation, one of which had become straw-coloured from the contrary cause. In another floret, upon the same day, I found many with their heads immersed in the woolly summit of the germen: some were in the interior valvule of the corolla; others appeared to be busy upon the plumose stigmata, upon which I did not observe that any pollen had been discharged from the anthers. Upon the twenty-second I observed that the larvæ were usually in the situation represented in the accurate drawing engraved in the third volume of the Linnean Society's Transactions (*l*). All circumstances considered, it seems to me most probable, that these animals do not feed upon the pollen before it is discharged from the anthers (*m*); yet one would think that in this case sufficient must escape them to fertilize the germen. How they prevent this I can but conjecture; as their heads are often immersed in the stigmata, and in the down observable upon the top of the germen, it is possible they may occasion an obstruction in those fine ducts through which the fertilizing principle passes down into the grain; or they may consume that spermatic moisture upon the stigma, without the aid of which the pollen cannot perform its office. On the twenty-ninth the parent *Tipulæ* had all disappeared, and soon after this period my investigations were stopped by illness;

(*i*) Tab. iv. fig. 2. d.(*k*) Fig. 2. e.(*l*) Tab. xxii. fig. 10.(*m*) Except perhaps when they are newly hatched.

but

but as I had brought them down so far as to connect them with those made last year (*n*), this interruption was of less consequence.

Before I take leave of this part of my subject, and give some account of the *Ichneumons* mentioned above, I must observe that the female of *Tipula Tritici* approaches very near to the female of one described by Geoffroy (*o*), which Fourcroy and Villars after him have called *Tipula immaculata*. His definition of that insect, "*atralis niveis*," and his description in French, answer exactly to a minute black *Tipula*, which I find common upon the wheat, remarkable for its beautiful plumose antennæ (*p*). The female, he observes, is very different from the male, and it is necessary to have seen them copulating, not to make of it another species. It is short, thick, yellow, with black eyes (*q*). He speaks of his insect as common in gardens, a situation in which I have never found *Tipula Tritici*. This description certainly approaches very near to our female, yet the colour of that is deep orange, and not yellow: besides, he makes no mention of the beautiful prismatic hues which adorn the wings. The black male, mentioned above, disappears at the same time with our female of the wheat, but it agrees in no respect with the specimen you received from Mr. Markwick: besides, I found another black one, which appeared to me to be its female.

I shall now proceed to give you some further account of the insects which prey upon *Tipula Tritici*. I have reason to believe, as I

(*n*) Linn. *Transf.* iv. p. 230.

(*o*) *Hist. ab. des Inf.* ii. p. 567. n. 26.

(*p*) Le mâle de cette petite espèce est allongé comme les précédens, avec le ventre mince et en filet. Sa couleur est partout d'un noir matte. Ses antennes forment de beaux plumets. Ses aîles sont d'un blanc laiteux, qui se fait d'autant plus remarquer, que son corps est fort noir.

(*q*) La femelle est très différente, & il faut les avoir vû accouplés ensemble pour n'en pas faire une autre espèce. Elle est courte, grosse, de couleur jaune, avec les yeux noirs. On trouve cette Tipule partout dans les bosquets des jardins.

hinted

hinted before, that there are not less than three *Ichneumons* attached to it. If Providence for wise ends has created so destructive an insect, it has been no less attentive to prevent it from becoming too numerous, by making it the food of so many other insects.

Upon the seventh of June I observed a very minute *Ichneumon* exceedingly busy upon the ears of wheat, which at first I took for *Ichneumon Tipulæ* (*r*); but upon a closer examination I found it to be a species entirely distinct (*s*), as will appear when I come to describe it. As soon as I was convinced of this, and observed that it pierced the florets at a time when no larvæ had made their appearance, I conjectured that it must lay its eggs in the eggs of the *Tipula*. How far this conjecture was well or ill founded must be determined by future observations, as I do not think I have collected facts sufficient to decide the question. This insect is furnished with an *aculeus* three or four times its own length (*t*), which is finer than a hair and nearly as flexile: this is commonly concealed within the abdomen, but when the animal is engaged in laying its eggs it is exerted: one day it gave me a full opportunity of examining this process. It inserts its *aculeus* between the valvules of the corolla near the top of the floret; its antennæ are then nearly doubled and motionless, its thorax is elevated, and its head and abdomen depressed: the latter, when it withdraws the *aculeus*, is moved frequently from side to side before it can extricate it. This insect has allowed me to examine its operations under a lens for six or seven minutes: upon opening the floret into which it had introduced its *aculeus*, I could find neither egg nor larva of the *Tipula*; but, upon examining it very closely under three glasses, I discovered, scattered over one of the valvules of the corolla, a number of globular eggs

(*r*) Linn. Transf. iv. p. 226. Tab. iv. fig. 8.

(*s*) Fig. 4.

(*t*) Fig. 5. a.

extremely minute (*v*), evidently not those of that insect. It is possible that there were in this floret eggs of the latter, which might be destroyed upon opening it, or escape my observation. At other times I have found eggs of *Tipula Tritici*, and once some larvæ, in florets upon which I had observed this *Ichneumon* busy. If we reason from analogy, and the general habits of the genus *Ichneumon*, the eggs of this insect ought to be deposited in some other insect in one of its states; but, in the instance above mentioned, it seems only to have been attentive to scatter them in such a situation as might lead them when hatched to their proper food. From the time in which it first makes its appearance, ten days before the hatching of the first larvæ, I am inclined to adopt my original conjecture, that the eggs are its prey; and yet there seems not to be a sufficient disproportion between the size of the one and the other for this purpose; at least it must take more than one to nourish a larva of the *Ichneumon* to its proper size. Where we are not in possession of sufficient instances to establish any fact beyond doubt, it would be great presumption to be too positive; I shall not therefore pretend to decide in which of its states our fly furnishes food to the offspring of this *Ichneumon*. I think we may with more confidence affirm, that it is attached to *Tipula Tritici* in one of them. The circumstance of its depositing its eggs within the florets of the wheat, in the very situation chosen by that insect for the same purpose, and usually where either its eggs or larvæ were concealed, sufficiently establishes this point; unless we may suppose it to prey upon *Thrips Physapus*. This latter insect, however, to the best of my recollection, I did not find in any of those florets which I examined after seeing this *Ichneumon* insert its *aculeus* into them. It is probable that its appearance is later, as there is no mention of it in my memoranda of this year.

(*v*) Tab. iv. fig. 5. b.

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On the twenty-second of June I observed another *Ichneumon* (w), not uncommon, piercing the florets of the wheat. This species did not appear to insert its *aculeus* between the valvules of the corolla, but to pierce the glumes of the calyx; to effect which purpose it is armed with a very short one sub-exserted: of this I found both the sexes; the male was distinguished from the female by its large eyes, placed very near each other, with reticulations unusually visible. I presume this to lay its eggs in the larvæ, but have not been able positively to ascertain the fact. Upon the same day that I first observed this species, our *Ichneumon Tipulæ* made its appearance in great numbers; a strong proof that the larvæ were now generally hatched. Concerning this *Ichneumon* I have no new remarks to offer, except that it must introduce itself within the floret to come at the larvæ, as appears from its mode of laying its eggs (x): so that these three enemies of the *Tipula* have each a different method of attacking it. The first undermines its little fortrefs, the second makes a breach in the walls, and the third carries it by storm (y).

Amongst the insects of other genera that I particularly noticed upon the wheat this season, the *Aphis granaria* (z) was common; as was likewise a species of *Cimex* in all its states, but I could not perceive that it devoured our *Tipula*. It answers in some respects to *C. lateralis* of Fabricius (a), but in others it differs much from it: I shall add a description of it to the others at the end of this letter.

(w) Tab. iv. fig. 10.

(x) Linn. Transf. vol. iii. p. 243. and vol. iv. p. 236.

(y) On the fourth of July I saw another *Ichneumon* inserting its *aculeus* into a floret of wheat, but it evaded my endeavours to take it. It seemed much too large to have any connection with our *Tipula*.

(z) Linn. Transf. vol. iv. p. 238, note \*.

(a) Fabr. Sp. Inf. 2. p. 372. n. 209. Linn. Syst. Nat. ed. Gmel. p. 2190. n. 517.

Several species of the genus *Empis* also frequented the wheat fields, often carrying off our *Tipula* in their diminutive beaks.

I have now given you as complete an account of these insects as the observations of the present year enable me. Something still remains to be done; for instance, to ascertain the male, the hybernacula of the pupa, to collect further facts relative to the two new *Ichneumons*, and, from observations taken in successive years, to determine how far our crops of this grain depend upon the increase or decrease of the *Tipula* and its *Ichneumons*.

*Cui bono?* is a query often put to naturalists; and the agriculturist perhaps will ask upon the present occasion, Can you inform us how we may prevent or diminish the ravages of these insects? In reply to this, I would observe, that the first step towards curing a disorder, is to find out its cause. In the present instance this is the business of the naturalist, and this *is* done. The intelligent farmer has no longer to ask what occasions the mischief; all he has now to do, is to aim at discovering a remedy. By a set of experiments first made upon a small scale, he may possibly find out some method that will prevent this insect from laying its eggs in his wheat: these should commence as soon as the ear begins to quit the *folium vaginans* or hofe; and they ought to be continued till the germen is impregnated, or, to use the rural phrase, the wheat is off the blossom. Perhaps fumigations of tobacco or sulphur, if made when the wind was favourable, might render the ear disagreeable to this insect. Much of the injury which this fly does, in years peculiarly favourable to its increase, it is possible, by some such means might be prevented; yet it is not certain that the total annihilation of it would be ultimately beneficial (*b*). But be it granted that our labours lead  
the

(*b*) We are very apt to think, that if certain noxious species of animals could be annihilated, it would be a great benefit to the human race; an idea that arises only from our

the way to no discovery of this kind, may it be said that we have been idly busy and unprofitably laborious, when we have succeeded in developing some of the most curious mysteries of nature, and in laying open the history of some of those secondary causes, which, guided by the hand of Providence, produce scarcity or plenty as the one or the other preponderate?

As I made my description of *Tipula Tritici* last year from a single specimen, and that produced before its time, it will hardly be deemed tautology if I draw out a new one; more especially as an error with respect to the colour of its wings, much calculated to mislead an examiner, has crept into it. In my MS. I find it "*alis albidis*," but I see it is printed "*alis hyalinis*," an expression which completely misrepresents their colour. As two new species of *Ichneumon* are to be described, it may also not be amiss to work over again the description of *Ichneumon Tipulæ* with a view to them:

#### TIPULA *Tritici*.

T. rufo-fulva; oculis nigris; alis lacteo-iricoloribus margine pilosis.

#### Fœmina (c).

Tota rufo-fulva; thorax intensius, pedes autem dilutius. *Antennæ* corpore sublongiores, duodecim-articulatæ articulis pedicellatis

short-sightedness, and our ignorance of the other parts of the great plan of Providence. We see and feel the mischief occasioned by such creatures, but are not aware of the good ends answered by them, which probably very much exceed it. I have heard of farmers, who, after having taken great pains to destroy the rooks from their farms, upon being successful, have suffered infinitely more in their crops, from the great increase of the larvæ of insects, before kept under by these birds, than they ever did from the rooks themselves. The same might be the case, could we annihilate the *Tipula* of the wheat; for every link of the great chain of creation is so closely connected on each side with others, and all parts so combine into one whole, that it seems not easy to calculate the consequences that would arise from the entire removal of the most insignificant, if any can be deemed such, from the system.

(c) Tab. iv. fig. 1.

oblongis

oblongis medio constrictis (*d*), pilosulæ, nigricantes. *Oculi* nigri suprà conniventes. *Alæ* corpore longiores, amplæ, apice rotundatæ; margine omni, sed interiori præcipuè, piloso; lacteæ coloribus prismaticis pro situ variè micantes. *Abdomen* vaginâ instructum retractili aculeum longissimum filiformem exferente.

Longitudo corporis (*vaginâ exclusâ*) lin. i.

*Tritici* spicas primâ æstate vesperi circumvolitat, intra flosculos aculeum ani inferens, ova inibi positura post quatuordecim dies larvæ exclusæ polline antherarum vel nectare stigmatum vescuntur granum exinanientes (*e*).

ICHNEUMON. *Minuti, abdomine ovato sessili.*

1. *inferens*. I. ater; antennis capitatis; abdomine lanceolato nitido (*f*).

*Corpus* atrum. *Antennæ* fractæ capitatæ. *Caput* et *thorax* subobscuri. *Alæ* hyalinæ aveniæ corpore longiores; superiores lineolâ nigrâ, a basi versus medium ductâ, puncto rotundo desinenti, notatæ. *Abdomen* lanceolatum, aterrimum, nitidissimum, valdè acutum, aculeum longissimum flexilem exferens. *Pedes* nigrescentes femoribus atris subclavatis.

Longitudo corporis infra lineam.

Præcedenti æqualis et hostis; horis diurnis circa spicas triticeas volans. In cujus flosculis, aculeo inserto, ovis *Tipulæ Tritici*, uti suspicor, ovula sua committit.

(*d*) Tab. iv. fig. 3. The singular form and mode of insertion of the joints of the antennæ are not to be seen, but under a powerful magnifier.

(*e*) Qu. Does Linnæus's *Ichneumon fecalis* (Syst. Nat. Gmel. p. 2714. n. 70) belong to the larva of a *Tipula*?

(*f*) Fig. 4.

The antennæ of this very minute insect are exceedingly singular (*g*). The first joint is long, rigid, and clavate (*b*); examined in a certain direction obcordato-bifid at the apex; this division serves as a socket for the next joint to act in (*i*), which is connected with it by means of a strong membrane or muscle (*k*), and performs the part of a ball or pivot: the four next joints are perfectly globular (*l*), and extremely minute: the clava, unless under a very powerful magnifier, appears solid; but, in that case, it is plainly discerned to consist of four articulations very closely set together (*m*).

2. *Tipulæ*. I. niger; antennis basi pedibusque rufis; tibiis posticis clavatis apice nigris; abdomine obovato (*n*).

*Corpus* nigrum. *Antennæ* fractæ vibratoriæ, thorace longiores, rufæ articulis quatuor ultimis majoribus nigris. *Caput et thorax* subobscuri. *Alæ* ævenæ immaculatæ, corpore longiores. *Abdomen* obovatum, nitidissimum, subdepressum, subsessile. *Pedes* rufi s. rufo-testacei, tibiis clavatis, posticis apice nigris.

Longitudo corporis infra lineam.

*Tipulæ Tritici* larvis contemporaneus, infestus, quibus concredit ovula sua, ovum unicum deponens singulis.

The antennæ of this insect, as well as every other part, are extremely different from those of the last. They consist first of a very long joint rather flexuous (*o*); from this to the four last joints, under a powerful magnifier, we could discover no articulations (*p*), and yet from the mode in which this part of the antennæ appears sometimes to be bent, I cannot help suspecting that there are some,

(*g*) Tab. iv. fig. 6, 7.

(*b*) Fig. 7. a.

(*i*) c.

(*k*) b.

(*l*) d.

(*m*) Fig. 7. e.

(*n*) Fig. 8.

(*o*) Fig. 9. a.

(*p*) Fig. 9. b.

although

although extremely minute. The four last joints are black, very distinct, and much larger than the rest (*q*).

3. *penetrans*. I. nigro-æneus; abdomine atro-cærulefcente, compresso; ano truncato, aculeo sub-exserto (*r*).

*Corpus* nigro-æneum, nitidum. *Antennæ* nigræ, clavatæ, thorace breviores, acutæ. *Alæ* aveniæ, hyalinæ; superiores lineolâ mediâ marginis crassioris nigrâ demum in discum obliquè incurrente, et puncto rotundo definenti. *Abdomen* atro-cærulefcent, sub-compressum, ano truncato, aculeo sub-exserto.

Longitudo corporis infra lineam.

*Triticum* frequentat simul cum præcedenti, glumas aculeo brevi penetrans ovula positurus. Maris oculi majores, pallidiores, approximati.

The clava of the antennæ of this little insect consists of four joints set close together (*s*); the last is the largest, and acute. We could not with certainty determine whether its footstalk was jointed or not.

I owe the drawings of the antennæ of the three last insects to the accurate eye and pencil of the Rev. Peter Lathbury, of Woodbridge, F. L. S. a most ingenious and intelligent naturalist. These *Ichneumons* (*t*) may be placed after *Ichneumon fecalis* of Linnæus, and *Tipula Tritici* after *Tipula Pini* of De Geer.

(*q*) Tab. iv. fig. 9. c.

(*r*) Fig. 10.

(*s*) Fig. 11. a.

(*t*) The remarkable variations in the form of the antennæ in these three species, undoubtedly of one genus, sufficiently prove that Geoffroy was wrong in separating his genus *Eulophus*, &c. from *Ichneumon* merely on account of that circumstance. *Hist. ab. des Inf.* ii. p. 312. pl. xv. fig. 3.

I shall

I shall now, as I promised above, proceed to describe the *Cimex* which I found so common upon the wheat in all its states.

**CIMEX.** *Oblongi, antennis setaceis longitudine corporis.*

*Tritici.* C. angustus, niger; thoracis lateribus, coleoptrorum limbo, femoribusque pallidis.

*Corpus* valde angustum, nigrum. *Rostrum* thoracis longitudine, pallidum. *Antennæ* obscurè rufæ articulo primo majore pubescenti, nigro. *Caput*, fronte acuta, posticè pallidum, lineâ intermediâ longitudinali exaratum. *Oculi* prominuli. *Thorax* anticè angustior, lateribus lineolisque tribus intermediis posticis, pallidis. *Scutellum* nigrum lineâ intermediâ elevatiusculâ. *Elytra* nigricantia margine exteriori latè pallida, pallore paululùm virenti. *Alæ* hyalinæ iricolores. *Pedes* lividi, tibiis tarsisque posticis nigris.

Longitudo corporis lin. 4.

Habitant in *Tritici* culmis et spicis, *Larva*, *Pupa*, *Imago*.

So much for this year's observations upon *Tipula Tritici*.

Believe me, &c. &c.

EXPLA-